

CONTENTS OF VOLUME 77

Journal of

Computational Physics

VOLUME 77, 1988



ACADEMIC PRESS, INC.

Harcourt Brace Jovanovich, Publishers

San Diego New York Boston

London Sydney Tokyo Toronto

Copyright © 1988 by Academic Press, Inc.
All Rights Reserved

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the copyright owner.

The appearance of the code at the bottom of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use, or for the personal or internal use of specific clients. This consent is given on the condition, however, that the copier pay the stated per copy fee through the Copyright Clearance Center, Inc. (27 Congress Street, Salem, Massachusetts 01970), for copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale. Copy fees for pre-1988 articles are as shown on the article title pages; if no fee code appears on the title page, the copy fee is the same as for current articles.

0021-9991/88 \$3.00

Printed by Catherine Press, Ltd., Brugge, Belgium

CONTENTS OF VOLUME 77

NUMBER 1, JULY 1988

Z. CSÉPES AND J. PIPEK. An Effective Recursive Algorithm for Generating Many-Body Hugenholtz and Goldstone Diagrams	1
CLAUS-DIETER MUNZ. On the Numerical Dissipation of High Resolution Schemes for Hyperbolic Conservation Laws	18
KENICHI MATSUNO AND HARRY A. DWYER. Adaptive Methods for Elliptic Grid Generation	40
MICHAEL S. BARNES, TINA J. COTLER, AND MICHAEL E. ELTA. A Staggered-Mesh Finite-Difference Numerical Method for Solving the Transport Equations in Low Pressure RF Glow Discharges	53
G. NAOURI, C. DEUTSCH, O. ATABEK, AND R. LEFEBVRE. Successive Embeddings of Excited Atomic Dipoles in Plasmas	73
LISA J. FAUCI AND CHARLES S. PESKIN. A Computational Model of Aquatic Animal Locomotion	85
JEFFREY G. BLASCHAK AND GREGORY A. KRIEGSMANN. A Comparative Study of Absorbing Boundary Conditions	109
G. H. SCHMIDT AND F. J. JACOBS. Adaptive Local Grid Refinement and Multi-grid in Numerical Reservoir Simulation	140
WILHELM HEINRICHS. Line Relaxation for Spectral Multigrid Methods . .	166
BARRY KOREN. Defect Correction and Multigrid for an Efficient and Accurate Computation of Airfoil Flows	183
ARTHUR RIZZI. Multi-cell Vortices Computed in Large-Scale Difference Solution to the Incompressible Euler Equations	207
JACK K. HALE AND NATALIA STERNBERG. Onset of Chaos in Differential Delay Equations	221
DAVID G. DRITSCHEL. Contour Surgery: A Topological Reconnection Scheme for Extended Integrations Using Contour Dynamics	240

NOTES

ORA E. PERCUS AND JEROME K. PERCUS. Long Range Correlations in Linear Congruential Generators	267
ROGER G. GRIMES AND HORST D. SIMON. New Software for Large Dense Symmetric Generalized Eigenvalue Problems Using Secondary Storage	270
ANTONIO L. GUERRERO AND PABLO MARTÍN. Higher Order Two-Point Quasi-Fractional Approximations to the Bessel Functions $J_0(X)$ and $J_1(X)$	276

LIST OF FORTHCOMING ARTICLES	282
--	-----

WILLIAM W. ROBERTS, JR., AND MARK A. HAUSMAN. Hypersonic, Stratified Gas Flows Past an Obstacle: Direct Simulation Monte Carlo Calculations	283
V. COLOMBO, P. RAVETTO, AND M. SUMINI. Variational Determination of the Neutron Integral Transport Equation Eigenvalues Using Space Asymptotic Trial Functions	318
WILLIAM S. LAWSON. Artificial Cooling Due to Quiet Injection in Bounded Plasma Particle Simulations	330
WEN-QIANG LU AND HSUEH-CHIA CHANG. An Extension of the Biharmonic Boundary Integral Method to Free Surface Flow in Channels	340
P. GLAISTER. An Approximate Linearised Riemann Solver for the Three-Dimensional Euler Equations for Real Gases Using Operator Splitting	361
B. L. SMITH. A General Numerical Procedure for the Treatment of Moving Interfaces in Implicit Continuous Eulerian (ICE) Hydrodynamics	384
SATTELURI R. K. IYENGAR AND RAM MANOHAR. High Order Difference Methods for Heat Equation in Polar Cylindrical Coordinates	425
CHI-WANG SHU AND STANLEY OSHER. Efficient Implementation of Essentially Non-oscillatory Shock-Capturing Schemes	439
HOSSEIN HAJ-HARIRI. Transformations Reducing the Order of the Parameter in Differential Eigenvalue Problems	472
R. L. DEWAR AND H. J. GARDNER. A Harmonic Expansion for the Magnetic Field of the Helical Solenoid	485
HAFAZ KOBEISSI AND MAJIDA KOBEISSI. A New Variable Step Method for the Numerical Integration of the One-Dimensional Schrödinger Equation	501
R. MANOHAR, S. R. K. IYENGAR, AND U. A. KRISHNAIAH. High Order Difference Methods for Linear Variable Coefficient Parabolic Equation	513
BRYAN BASDEN AND ROBERT R. LUCCHESI. High-Order Newton-Cotes Integration Methods in Scattering Theory	524

NOTES

ANDREW D. BOOTH AND IAN J. M. BOOTH. A Note on the Progressive Calculation of the Mean and Variance	537
THIAB R. TAHA AND MARK J. ABLOWITZ. Analytical and Numerical Aspects of Certain Nonlinear Evolution Equations. IV. Numerical, Modified Korteweg-de Vries Equation	540

LIST OF FORTHCOMING ARTICLES	549
--	-----

AUTHOR INDEX FOR VOLUME 77	550
--------------------------------------	-----

Journal of Computational Physics

INFORMATION FOR AUTHORS

The purpose of the *Journal of Computational Physics* is to publish articles concerning techniques developed in the solution of data handling problems and mathematical equations, both arising in the description of physical phenomena.

Manuscripts should be submitted to: The Editors, *Journal of Computational Physics*, University of California, Lawrence Livermore National Laboratory, P. O. Box 5509, L-561, Livermore, California 94550, U.S.A.

Only original papers will be considered. Manuscripts are accepted for review with the understanding that the same work has not been and will not be nor is presently submitted elsewhere, and that its submission for publication has been approved by all of the authors and by the institution where the work was carried out; further, that any person cited as a source of personal communications has approved such citation. Written authorization may be required at the Editors' discretion. Articles and any other material published in the *Journal of Computational Physics* represent the opinions of the author(s) and should not be construed to reflect the opinions of the Editors and the Publisher.

Authors submitting a manuscript do so on the understanding that if it is accepted for publication, copyright in the article, including the right to reproduce the article in all forms and media, shall be assigned exclusively to the Publisher. The Publisher will not refuse any reasonable request by the author for permission to reproduce any of his or her contributions to the journal.

Form of Manuscript. Manuscripts should be typewritten with wide margins on high quality 8.5×11 -in. bond paper, using double spacing throughout. If larger paper must be used, the text must still be within these dimensions. A minimum of three copies should be submitted; however, in order to expedite handling of manuscripts, five copies are desirable. The original of the manuscript and figures (including computer-generated data) need not be submitted until acceptance, as long as the copies are clear and reproducible. Figures and tables must be in all copies.

Each page of the manuscript should be numbered consecutively. Page 1 should contain the article title, author, and coauthor names with complete affiliation(s). At the bottom of this page should appear the subject classifications and key words (see below). Page 2 should contain a proposed running head of less than thirty-five characters. It should also contain the name and complete mailing address of the person to whom proofs are to be sent. Page 3 of full articles should contain a short abstract.

Notes. Short notes of 10 pages or less (including figures, tables, and references but excluding title pages) regarding the availability of interesting and useful new programs or tabular material will be considered for publication. Letters to the Editor commenting on articles already published in this Journal will also be considered. Neither notes nor letters should have an abstract.

With the exceptions noted below, authors should be guided by the *Style Manual*, 1978, of the American Institute of Physics.

Subject Classification. Authors are required to classify their own manuscripts using the 1980 *Mathematics Subject Classification*, reprinted from the 1978 *Mathematical Reviews Index*, pp. S27-S34, with the additional classifications listed in the January 1, 1981 issue. Authors are requested to choose at least two categories—one in numerical analysis category 65, and one other (generally a physical classification) from the categories beyond 65.

List of Symbols. If the paper is accepted for publication, it is of vital importance that the author submit a complete list of symbols. The symbols used should be identified for the typesetter **phonetically**. This list will not appear in print but is essential to avoid costly corrections in proof. The author may prepare his or her own list or use a preprinted form supplied by the Editors.

Tables. Number tables consecutively with Roman numerals. Extensive tables will be reproduced photographically and should be typed carefully in the **exact** format desired. Authors will be charged for any new photoreproductions necessitated by changes in proof. Use superscript lowercase italic letters for table footnotes, which should be typed immediately below the table. Type tables at least double-spaced, including titles and footnotes. Do not underline table titles; reserve underlining for text that is to be italicized.

Equations. Equations should be typewritten whenever possible and the number placed in parentheses at the right margin. Reference to equations should use the form "Eq. (3)" or simply "(3)." Superscript and subscripts should be typed or handwritten clearly above and below the line, respectively. Use the exponent $1/2$ whenever possible.

References. References should be cited in the text by a number in square brackets. Literature cited should appear on a separate page at the end of the article and should be styled and punctuated according to the standards of the American Physical Society and using standard abbreviations for journals (see *Chemical Abstracts Service Source Index*, 1985). See the following examples:

1. D. SCHNACK AND J. KILLEEN, *J. Comput. Phys.* **35**, 110 (1980).
2. I. GOHBERG, P. LANCASTER, AND L. RODMAN, *Matrix Polynomials* (Academic Press, New York, 1982), p. 54.
3. R. GROSS, M. KOYANAGI, H. SEIFERT, AND R. P. HUEBENER, in *Proceedings, 17th Int. Conf. on Low Temperature Physics, Karlsruhe, West Germany, 1984*, edited by U. Eckern *et al.* (North-Holland, Amsterdam, 1984), p. 431.

For unpublished lectures or symposia, include title of paper, name of sponsoring society in full, and date. Abbreviation of DOE Laboratory report names should follow the style of *Nuclear Science Abstracts*. Give titles of unpublished reports with "(unpublished)" following the reference. Further examples and instructions are available from the Editors.

Footnotes. Footnotes in the text should be avoided if at all possible. If they must be used, identify by superscript numbers and type together on a separate page, double-spaced.

Figures. All illustrations are to be considered as figures. Number each graph or drawing in sequence with Arabic numerals. Supply a descriptive legend for each figure. Type legends double-spaced consecutively on a separate page.

Plan figures to fit the proportion of the printed page. Use a professional lettering set on the original so that the letters and numbers are large enough and "open" enough to take a reduction of 50 to 60% without filling in the ink. Do not include background grids; however, on paper with blue lines the grid can be eliminated in the process of photoreproduction. Identify each figure in a margin with the name of the journal, author's name, and figure numbers; avoid marking the backs of figures.

Proofs. Proofs will be sent to the author with a reprint order form. Authors will be charged for alterations in excess of 10% of the cost of composition.

Reprints. Fifty reprints without covers will be provided free of charge. Additional reprints may be purchased.

*An International Journal Designed for
the Diverse Community of Users and Developers
of Novel X-Ray Imaging and Analysis Techniques*

New **Journal of X-Ray Science and Technology**

Editor-in-Chief: Larry Knight
Brigham Young University, Provo, Utah

The historically difficult field of x-ray analysis is facing urgent new challenges (e.g., x-ray microlithography, x-ray astronomy). At the same time, new technologies arising from fields traditionally considered unrelated to x rays (semiconductor processing, accelerator technology, etc.) are presenting opportunities for new devices and the enhancement of traditional devices that can meet the new challenges as they arise. A short list of these developments would include: synchrotrons, x-ray lasers, x-ray image formation by charge-coupled devices, and parallel processing for image reconstruction. In addition, opportunities for novel applications of x rays are developing in many other areas such as materials science, analytical chemistry, plasma sciences, biology, medicine, and nondestructive testing.

Because of the dynamic nature of these developments, it is important that interested scientists and engineers have a single literature source that will provide clear and full coverage of new developments in the field. The **Journal of X-Ray Science and Technology** intends to meet this need by publishing reports of original research and timely reviews of the best technical and esthetic quality possible.

Volume 1 (1988), 2 issues
In the U.S.A. and Canada: \$50.00

ISSN 0895-3996
All other countries: \$56.00

Manuscripts may be submitted in quadruplicate to:
JOURNAL OF X-RAY SCIENCE AND TECHNOLOGY
Editorial Office
1250 Sixth Avenue, San Diego, CA 92101

*Sample copies and privileged personal rates are available upon request.
For more information, please refer to S8072 and write or call:*



ACADEMIC PRESS, INC., Journal Promotion Department
1250 Sixth Avenue, San Diego, CA 92101, U.S.A.
(619) 230-1840

S8028